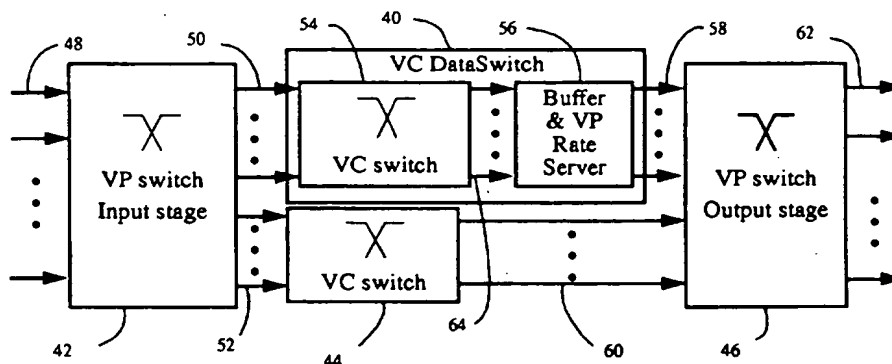




## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)


(51) International Patent Classification <sup>5</sup> : <b>H04L 12/56, H04J 3/22</b>	<b>A1</b>	(11) International Publication Number: <b>WO 94/23517</b> (43) International Publication Date: 13 October 1994 (13.10.94)
(21) International Application Number: PCT/AU94/00150 (22) International Filing Date: 28 March 1994 (28.03.94) (30) Priority Data: PL 7981 26 March 1993 (26.03.93) AU (71) Applicant (for all designated States except US): CURTIN UNIVERSITY OF TECHNOLOGY [AU/AU]; Kent Road, Bentley, W.A. 6102 (AU). (72) Inventors; and (75) Inventors/Applicants (for US only): HULLETT, John, Leslie [AU/AU]; 75 Selbey Street, Daglish, W.A. 6008 (AU). CANTONI, Antonio [AU/AU]; 10 Yallambee Place, City Beach, W.A. 6105 (AU). BUDRIKIS, Zigmantas, Leonas [AU/AU]; 7 Hotchin Street, Dalkeith, W.A. 6009 (AU). (74) Agent: MIZZI, Anthony, Paul; Griffith Hack & Co., 6th floor, 256 Adelaide Terrace, Perth, W.A. 6000 (AU).		(81) Designated States: AT, AU, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, ES, FI, GB, GE, HU, JP, KG, KP, KR, KZ, LK, LU, LV, MD, MG, MN, MW, NL, NO, NZ, PL, PT, RO, RU, SD, SE, SI, SK, TT, UA, US, UZ, VN, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).  Published With international search report.

(54) Title: METHOD AND APPARATUS FOR MANAGING THE STATISTICAL MULTIPLEXING OF DATA IN DIGITAL COMMUNICATION NETWORKS



## (57) Abstract

An apparatus and method for supporting a plurality of virtual channel (VC) connections within a single virtual path (VP) in a digital communications network operating in the Asynchronous Transfer Mode (ATM) is described. The apparatus (56) is combined with the cross-connect part of a conventional VC switch (54) to form a Data Switch (40). A VP switch (42) switches and terminates incoming bandwidth-resourced VPs on lines (48), some of which are carrying non-bandwidth-resourced VCs and switched onto lines (50) on the output side of VP switch (42). VPs on lines (50) are switched and multiplexed by the Data Switch (40). The apparatus (56) comprises buffers (66) for storing cells and a VP rate server. The buffers (66) are significantly larger than in a conventional VC switch to enable smoothing of data flow peaks associated with data flowing from multiple bandwidth resourced VP tributaries into single resourced VP tributaries. Notwithstanding the large buffers in the Data Switch (40) there may still be congestion when data bursts occur on several converging streams. When buffer overflow is threatened, the Data Switch (40) discards whole frames, i.e., whole VPI-VCI sequences marked with an end of transmission delimiter in the PTI, rather than individual cells originating from different frames as would be the case with normal ATM cell multiplexing. The Data Switch also employs rate shaping by virtual scheduling and implemented by linked lists used to read data from the Data Switch buffers into bandwidth resourced VPs.

<b>A. CLASSIFICATION OF SUBJECT MATTER</b> Int. Cl. <sup>5</sup> H04L 12/56, H04J 3/22  According to International Patent Classification (IPC) or to both national classification and IPC				
<b>B. FIELDS SEARCHED</b>  Minimum documentation searched (classification system followed by classification symbols) H04L 11/20, 12/56 H04J 3/22  Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched AU: IPC as above  Electronic data base consulted during the international search (name of data base, and where practicable, search terms used) DERWENT INPADOC				
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>				
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.		
A	WO,A, 92/19060 (N.V. PHILIPS) 29 October 1992 (29.10.92) Whole document	1-29		
P, A	AU,A, 41300/93 (TELSTRA CORPORATION LIMITED) 23 December 1993 (23.12.93) Whole document	1-29		
P, A	EP,A, 552121 (FRANCE TELECOM) 21 July 1993 (21.07.93) Whole document	1-29		
<div style="display: flex; justify-content: space-between; align-items: flex-start;"> <div style="width: 45%;"> <input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C.         </div> <div style="width: 45%;"> <input type="checkbox"/> See patent family annex.         </div> </div>				
<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top;"> <p>* Special categories of cited documents :</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </td> <td style="width: 50%; vertical-align: top;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>"&amp;" document member of the same patent family</p> </td> </tr> </table>			<p>* Special categories of cited documents :</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p>	<p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>"&amp;" document member of the same patent family</p>
<p>* Special categories of cited documents :</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p>	<p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>"&amp;" document member of the same patent family</p>			
Date of the actual completion of the international search 1 July 1994 (01.07.94)		Date of mailing of the international search report 15 JUL 94 (15.07.94)		
Name and mailing address of the ISA/AU  AUSTRALIAN INDUSTRIAL PROPERTY ORGANISATION PO BOX 200 WODEN ACT 2606 AUSTRALIA  Facsimile No. 06 2853929		Authorized officer    W. SENANAYAKE  Telephone No. (06) 2832183		

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate of the relevant passages	Relevant to Claim No.
P, A	WO,A, 93/19551 (TELEFONAKTIEBOLAGET L.M. ERICSSON) 30 September 1993 (30.09.93) Whole document	1-29
P, A	EP,A, 548995 (FUJITSU LIMITED) 30 June 1993 (30.06.93) Whole document	1-29

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
WO	9219060	AU	17468/92	CA	2084303	EP	533900
		HU	64656	JP	5508283	CZ	9203530
		DE	4120083				
AU	41300/93						
EP	552121	CA	2087120	FR	2686205	JP	5268181
WO	9319551	AU	37731/93	SE	9200868		
EP	548995	JP	5183569	JP	5244188		
END OF ANNEX							

## PATENT COOPERATION TREATY

PCT

NOTIFICATION CONCERNING  
DOCUMENT TRANSMITTED

From the INTERNATIONAL BUREAU

To:

United States Patent and Trademark  
Office  
(Box PCT)  
Washington D.C. 20231  
United States of America

in its capacity as elected Office

Date of mailing:

31 January 1995 (31.01.95)

International application No.:

PCT/AU94/00150

International filing date:

28 March 1994 (28.03.94)

Applicant:

CURTIN UNIVERSITY OF TECHNOLOGY et al

The International Bureau transmits herewith the following documents and number thereof:

---

copy of the international preliminary examination report (Article 36(3)(a))The International Bureau of WIPO  
34, chemin des Colombettes  
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorised officer:

M. Abidine

Telephone No.: (41-22) 730.91.11

## PATENT COOPERATION TREATY

PCT

## NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

United States Patent and Trademark  
Office  
Washington, D.C.

in its capacity as elected Office

Date of mailing:

26 October 1994 (26.10.94)

International application No.:

PCT/AU94/00150

Applicant's or agent's file reference:

International filing date:

28 March 1994 (28.03.94)

Priority date:

26 March 1993 (26.03.93)

Applicant:

HULLETT, John, Leslie et al

1. The designated Office is hereby notified of its election made:



in the demand filed with the International Preliminary Examining Authority on:

11 October 1994 (11.10.94)



in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was

was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO  
34, chemin des Colombettes  
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

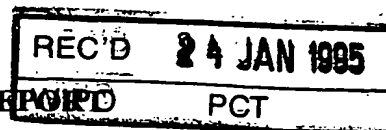
Authorized officer:

M.C. Taylor

Telephone No.: (41-22) 730.91.11

35


**PATENT COOPERATION TREATY**  
**PCT**  
**INTERNATIONAL PRELIMINARY EXAMINATION REPORT**



(PCT Article 36 and Rules 70)

Applicant's or agents file reference APM:CC	<b>FOR FURTHER ACTION</b>	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416).
International application No. <b>PCT/AU 94/00150</b>	International filing date 28 March 1994 (28.03.94)	Priority Date 26 March 1993 (26.03.93)
International Patent Classification (IPC) or national classification and IPC <b>Int. Cl. 5 H04L 12/56, H04J 3/22</b>		
Applicant (1) <b>CURTIN UNIVERSITY OF TECHNOLOGY</b> (2) <b>HULLETT, John Leslie et al</b>		

1.	This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2.	This REPORT consists of a total of 4 sheets, including this cover sheet.  <input type="checkbox"/> This report is also accompanied by ANNEXES, i.e., sheet of description, claim and/or drawings amended during international preliminary examination and/or containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).  These annexes consist of a total of sheets: _____
3.	This report contains indications relating to the following items:  I <input checked="" type="checkbox"/> Basis of the report  II <input type="checkbox"/> Priority  III <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability  IV <input checked="" type="checkbox"/> Lack of unity of invention  V <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement  VI <input type="checkbox"/> Certain documents cited  VII <input type="checkbox"/> Certain defects in the international application  VIII <input type="checkbox"/> Certain observations on the international application

Date of submission of the demand 11 October 1994 (11.10.94)	Date of completion of this report 16 January 1995 (16.01.95)
Name and mailing address of the IPEA/AU AUSTRALIAN INDUSTRIAL PROPERTY ORGANISATION PO BOX 200 WODEN ACT 2606 AUSTRALIA Facsimile No. (06) 2853929	Authorized officer  <b>R TOLHURST</b> Telephone No. (06) 2832178

**I. Basis of the report**

1. This report has been drawn on the basis of *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.)*:

- ☒ the international application as originally filed.
- ☐ the description,                      pages ..., as originally filed,  
   pages ..., as filed with the demand,  
   pages ..., filed with the letter of ...,  
   pages ..., filed with the letter of ...,
- ☐ the claims,                              Nos. ..., as originally filed,  
   Nos. ..., as amended under Article 19,  
   Nos. ..., filed with the demand,  
   Nos. ..., filed with the letter of ...,  
   Nos. ..., filed with the letter of ... ,
- ☐ the drawings,                           sheets/fig ..., as originally filed,  
   sheets/fig ..., filed with the demand,  
   sheets/fig ..., filed with the letter of ...,  
   sheets/fig ..., filed with the letter of ...,

2. The amendments have resulted in the cancellation of:

- ☐ the description, pages ...
- ☐ the claims, Nos. ...
- ☐ the drawings, sheets/fig ...

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

4. Additional observations, if necessary:



**IV. Lack of unity of invention**

1. In response to the invitation to restrict or pay additional fees the applicant has

- ☐ restricted the claims.
- ☐ paid additional fees.
- ☐ paid additional fees under protest.
- ☐ neither restricted nor paid additional fees.

2. ☐ This Authority found that the requirement of unity of invention is not complied with and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.

3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is

- ☐ complied with.
- ☒ not complied with for the following reasons:

The international application includes the following two inventions:

- (a) Claims 1-19 directed to a method and an apparatus for admitting cells into a buffer within a virtual path, all cells for a virtual channel connection are discarded after the detection of an end of the virtual channel transmission.
- (b) Claims 20-29 directed to a method and an apparatus for reading cells out of a buffer involving the calculation of cell arrival delay.

This authority did not invite the applicant to restrict or pay additional fees because all claims could be examined without effort justifying an additional fee.

4. Consequently, the following parts of the international application were the subject of international preliminary examination in establishing this report:

- ☒ all parts.
- ☐ the parts relating to claims Nos.

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement****1. STATEMENT**

Novelty (N)	Claims 1-29	YES
	Claims	NO
Inventive Step (IS)	Claims 1-29	YES
	Claims	NO
Industrial Applicability (IA)	Claims 1-29	YES
	Claims	NO

**2. Citations and explanations**Claims 1-19

None of the citations discloses a method/apparatus for admitting cells into a buffer within a virtual path, where all cells for a virtual channel connection are discarded after the detection of an end of the virtual channel transmission.

Claims 20-29

None of the citations discloses a method/apparatus for reading cells out of a buffer involving a calculation of cell arrival delay.